IN THE CLAIMS

1. (currently amended) In a regenerative heat exchanger for a fluid in a temperature range from 2K to 160K, the improvements ~~comprising~~ consisting of:

a thin, elongated sheet-like holding base ~~coated with an adhesive on one surface or both surfaces thereof~~;

numerous granules such as one or more of balls, chips and fine particles of a relatively uniform size of 40 μm to 800 ~~μm, of~~ μm of one or a plurality of materials having a high specific heat per volume in the temperature ~~range, and~~ range bonded not in contact with each other along a length and over a predetermined width of ~~the~~ one ~~surface~~ or both surfaces of the holding base.

2. (withdrawn) A sheet-type regenerative heat exchanger, obtained through the steps of:

providing an alignment substrate formed with numerous, precisely aligned small apertures which are constituted by through holes or dimples;

placing numerous granules such as balls, chips and fine particles having a relatively uniform particle diameter or size, which are made of one or a plurality of heat storing materials, into said small apertures such that each piece of the balls, chips, or fine particles is received in each one of the small apertures in the alignment substrate; and

bonding said balls, chips, or fine particles onto one or both surfaces of a very thin, elongated sheet-like holding base such as a cloth or film having an adhesive layer on one or both surfaces thereof, over a predetermined widthwise range along the length thereof.

3. (withdrawn) A sheet-type regenerative heat exchanger, obtained through the steps of:

providing an alignment substrate formed with numerous, precisely aligned small apertures;

placing numerous granules such as balls, chips and fine particles having a relatively uniform particle diameter or size, which are made of one or a plurality of heat storing materials, such that each piece of the balls, chips, or fine particles is received in each one of the small apertures in the alignment substrate; and

bonding said balls, chips, or fine particles onto one or both surfaces of a very thin, elongated sheet-like holding base such as a cloth or film having an adhesive layer on one or both surfaces thereof, over a predetermined widthwise range along the length thereof; wherein during the bonding step, numerous minute holes having a diameter equal to or less than a half of the particle diameter or size of the balls, chips, or fine particles are drilled in the sheet-like holding base at intermediate positions between adjacent small apertures formed in the alignment substrate by minute hole drilling means such as a laser electron beam.

4. (withdrawn) The sheet-type regenerative heat exchanger according to claim 3, wherein the diameter of said numerous minute holes formed in said alignment substrate is 80% or lower of the particle diameter or size of said granules such as balls, chips, and fine particles.

5. (previously presented) The sheet-type regenerative heat exchanger according to claim 1, wherein said granules are of one or more of Pb-Zn alloy, with or without plating of Pb or an alloy thereof.

6. (previously presented) The sheet-type regenerative heat exchanger according to claim 1, wherein said granules are made of one or more of an alloy having a high specific heat in the temperature range, such as Nd, $DyNi_2$, Er_3Ni, Er_6Ni_2Sn, $ErNi_{0.9}Co_{0.1}$, Gd_5Al_2, $HOCu_2$, $GdA10_3$, and $Nd_2Fe_{17}Al$, a magnetic oxide, and a magnetic substance.

7. (previously presented) The sheet-type regenerative heat exchanger according to claim 1, wherein said holding base is a woven cloth having a thickness of 10 to 100 μm, made from a fiber selected from the group consisting of paraaramid fiber, high tenacity polyarylate fiber, PBO fiber, polyethylene fiber, polytetrafluorethylene fiber, polyester fiber, polyamid fiber, natural fiber, and glass fiber, and has so small a mesh that said granules do not pass therethrough.

8. ((previously presented) The sheet-type regenerative heat exchanger according to claim 1, wherein said holding base is formed of film made of polypropylene, polyimide, capton, or the like, and has a thickness of 10 to 100 μm.

9. (previously presented) The sheet-type regenerative heat exchanger according to claim 1, wherein said holding base is formed of either paper or non-woven cloth made of either artificial fiber or natural substance as a base material, and has a thickness of 10 to 100 μm.

10. (previously presented) A regenerator including the sheet-type regenerative heat exchanger according to claim 1 wound in multiple layers around a core which is constituted by either one piece or divided pieces, formed in either a columnar shape or other shapes, and made of a material having an extremely low expansion coefficient and thermal conductivity.

11. (previously presented) The regenerator according to claim 10, wherein said core is a pulse tube.

12. (withdrawn) A method for manufacturing a sheet-type regenerative heat exchanger including:

a first step of randomly arranging, within a frame on a flat plate having extremely high flatness, at least one layer of numerous granules such as balls, chips, and fine particles which are made of a material having high specific heat per unit volume in a range of temperatures employed and have a relatively uniform particle size;

a second step of putting a sheet-like holding base coated with an adhesive, upon the granules; and

a third step of moving a roller under pressure on said sheet-like holding base to bond at least one layer of said granules onto said sheet-like holding base so that the granules sink into the adhesive by a depth equal to or lower than 30% of the height of said granules.

13. (withdrawn) A method for manufacturing a sheet-type regenerative heat exchanger including:

a first step of arranging numerous granules such as balls, chips, and fine particles which are made of one or a plurality of heat storing materials and have a relatively uniform particle diameter or size, onto an alignment substrate formed with numerous, precisely aligned small apertures, such that each piece of the balls, chips, or fine particles is received in each one of the small apertures;

a second step of putting a very thin sheet-like holding base such as cloth or film coated with an adhesive thereon; and

a third step of moving a roller under pressure on said sheet-like holding base to bond said granules onto said sheet-like holding base with a compressive strain inclined to the adhesive equal to or lower than 30% of the height of said granules.

14. (withdrawn) A method for manufacturing a sheet-type regenerative heat exchanger including:

a first step of arranging numerous granules such as balls, chips and fine particles which are made of one or a plurality of heat storing materials and have a relatively uniform particle diameter or size, onto an alignment substrate formed with numerous, precisely aligned small apertures such that each piece of the balls, chips, or fine particles is received in each one of the small apertures;

a second step of putting a very thin sheet-like holding base such as a cloth or film coated with an adhesive thereon;

a third step of moving a roller under pressure on said sheet-like holding base to bond said granules onto said sheet-like holding base with a compressive strain inclined to the adhesive equal to or lower than 30% of the height of said granules; and

a fourth step of drilling numerous small holes having a diameter equal to or less than a half of the particle diameter or size of the granules such as balls, chips and fine particles in the sheet-like holding base at intermediate positions between adjacent small apertures formed in the alignment substrate by small hole drilling means such as a laser electron beam.

15. (previously presented) In a regenerative cryogenic refrigerator, the improvement comprising a regenerative heat exchanger according to claim 1 for a regenerator.

16. (withdrawn) The sheet-type regenerative heat exchanger according to claim 2, wherein said granules are of one or more of Pb-Zn alloy, with or without plating of Pb or an alloy thereof.

17. (withdrawn) The sheet-type regenerative heat exchanger according to claim 3, wherein said granules are of one or more of Pb-Zn alloy, with or without plating of Pb or an alloy thereof.

18. (withdrawn) The sheet-type regenerative heat exchanger according to claim 4, wherein said granules are of one or more of Pb-Zn alloy, with or without plating of Pb or an alloy thereof.

19. (withdrawn) The sheet-type regenerative heat exchanger according to claim 2, wherein said granules are made of one or more of an alloy, having a high specific heat in the temperature range, such as Nd, $DyNi_2$, Er_3Ni, Er_6Ni_2Sn, $ErNi_{0.9}Co_{0.1}$, Gd_5Al_2, $HOCu_2$, $GdAl0_3$, and $Nd_2Fe_{17}Al$, a magnetic oxide, and a magnetic substance.

20. (withdrawn) The sheet-type regenerative heat exchanger according to claim 3, wherein said granules are made of one or more of an alloy having a high specific heat in the temperature range, such as Nd, $DyNi_2$, Er_3Ni, Er_6Ni_2Sn, $ErNi_{0.9}Co_{0.1}$, Gd_5Al_2, $HOCu_2$, $GdAl0_3$, and $Nd_2Fe_{17}Al$, a magnetic oxide, and a magnetic substance.